## SILVICULTURAL EXISTING CONDITIONS

### Introduction

The following describes the existing forest vegetation conditions and the effects of implementing the alternatives on forest health and sustainability in the Two Eagle project area. Specifics on the analysis are located in the project analysis file.

### Existing Condition

The Two eagle analysis area is in the geographical province of the Wallowa Mountains, in Baker County Oregon. The project area for the proposed action is 7,206 acres; the cumulative effects analysis will include, subwatersheds170502031002 (West Eagle Creek), 170502031001 (Eagle Creek) and 170502031003 (Bennet Creek- Eagle Creek). The area is managed under the Wallowa-Whitman National Forest, La Grande Ranger District.

### Management Directives

The Two Eagle project area is managed according to the Wallowa-Whitman National Forest's Land and Resource Management Plan (1990). The management areas (MA) are: MA 1 (timber production), MA 7 (wild and scenic rivers), MA 15 (old-growth preservation) and MA 15-7 (wild and scenic rivers and old-growth preservation).

In May 1994, Regional Forester John Lowe issued a decision notice for the Continuation of Interim Management Direction Establishing Riparian, Ecosystem and Wildlife Standards for Timber Sales (screens). This Decision Notice amended all forest plans east of the Cascade Mountains in relation to timber sale designs in riparian areas and late and old structural forest stands. The Two Eagle project is a proposed harvest operation with green volume being removed. All three screens (riparian, ecosystem and wildlife screens) must be applied.

**Management Activities:** The area is mostly roaded and has been harvested in the past, most recently in 1996. The private land in the planning area has had minimum vegetation management treatment consisting of mainly non-mechanized thinning of surface and ladder fuels.

86.6 percent of National Forest System lands in the Two Eagle analysis area are forested. When classified using potential vegetation groups (PVG), approximately 46 percent of the forested acres are "moist upland forest" which includes lodgepole pine/ big huckleberry, subalpine fir/big huckleberry, grand fir/ twinflower, grand fir/ huckleberry, grand fir/queens cup plant associations; 15 percent are "cold upland forest" which includes sub-alpine fir/grouse huckleberry, lodgepole pine/ grouse huckleberry, grand fir/ grouse huckleberry plant associations; and 26 percent of these forested lands are "dry upland forest" which includes Douglas-fir/ elk sedge, Douglas-fir/ pinegrass, grand fir/ pine grass, grand fir/ elk sedge(Table 1).

Table 1 - Potential vegetation groups (PVG) of the 2 Eagle forested analysis area

| PVG | Acres | Percent of Project Area |
|---|---|---|
| Moist Upland Forest | 3,317 | 46 |
| Dry Upland Forest | 1,872 | 26 |
| Cold Upland Forest | 1,047 | 15 |
| Total Forested Acres | 6,236 | 86.5 |
| Total Non-Forested Acres | 970 | 13.4 |

Cold Upland Forest Group
These sites are low to moderate in productivity. Cover types are used as classification for existing vegetation in stands. Cover type is based upon the dominant overstory species (poles to large size diameter trees) in a stand. Currently, grand fir (*Abies grandis*), subalpine fir (*Abies lasiocarpa*), spruce (*Picea engelmannii*), and lodgepole pine (*Pinus contorta*) cover types make up the majority for this group. Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*) and ponderosa pine *(Pinus ponderosa)* cover type arebelow the range of variability (Table 2).

Mortality in many stands is often less than or equal to 10% of the overstory. Active insects and diseases were observed in these stands. Specifically, Mountain Pine Beatle (*Dendroctonus ponderosae*) and Balsam Woolly Adelgid (Adelges piceae) are causing the majority of mortality in stands. Stand ages for overstory greater than 9" diameter breast height (DBH) is 80 to greater than 200 years old. Mortality and fuel loading are moderate with lower crown classes (intermediate or suppressed trees) having more damage. Success of regeneration is related to mortality and past disturbance. Stand cover ranges from 20%- 70%. This group is very susceptible to fires and can sustain stand replacement fires. Lodgepole, which in many areas is a major component of this type, is also susceptible to mountain pine beetle infestation which can become a serious problem. Understory re-initiation structure (38%), and old forest multi stratum (44%) dominates in this type. Many of these stands would remain in a dense, low vigor condition until a disturbance occurs.

**Table 2: Cold Forest current and desired species composition expressed as %**

| Vegetation Cover Type for Cold PVG | Range of variation for cover types (%) | Existing range of cover types (%) |
|---|---|---|
| Ponderosa Pine | 0-5 | <1 |
| Douglas-fir | 5 to 15 | <1 |
| Western Larch | 5 to 15 | <1 |
| Lodgepole Pine | 25-45 | 48 |
| Grand Fir | 5 to 15 | 19 |
| Subalpine fir and spruce | 15-35 | 33 |

Table 2: Range of variation information for species composition (vegetation cover type), expressed as percentages.

Moist Upland Forest Group
These sites are the most productive in the Blue Mountains. Species composition in these stands are dominated grand fir, followed by englemann spruce, both cover types are over represented on the landscape. Douglas-fir, western larch and ponderosa pine and lodgepole pine cover types are all below the range of variability (Table 3).

The degree of damage from insects is variable and depends upon factors such as species composition, tree size, tree vigor and occurrence of root/bole decays. Annosus (*Heterobasidion annosum)* was the most widespread disease found in these stands. Understories are dominated by grand fir and lodgepole pine regeneration with twinflower *(Linnaea borealis*) and big huckleberry (*Vaccinium membranaceum*). Low amounts of early seral species such as western larch occurs in the understory due to poor growing conditions (lack of sunlight). Mortality in many stands is less than 10% of the overstory with many of the intermediate tree class exhibiting live crown ratios less than 35%. Stand ages range from 75 to 300 years

old for trees greater than 9" DBH. Stand cover ranges from 18% to 70% with an average of 38%. Current structure in this type is dominated by old forest multi stratum (47%) and understory re-initiation (38%) stage. There are approximately 2-4 snags per acre of variable species and sizes.

**Table 3: Range of variation information for species composition expressed as % for Moist PVG**

| Vegetation Cover Type for Moist PVG | Range of variation for cover types (percentages) | Existing range of cover types (percentages) |
|---|---|---|
| Ponderosa Pine | 5 to 15 | <1 |
| Douglas-fir | 15-30 | <1 |
| Western Larch | 10 to 30 | <1 |
| Lodgepole Pine | 25-45 | 5 |
| Grand Fir | 15-30 | 82 |
| Subalpine fir and spruce | 1 to 10 | 13 |

Dry Upland Forest Group

These sites are low to moderate in productivity. Past activities and fire exclusion have led to an increase in the understory components of these stands, which has led to an increase of ladder fuels into the larger trees. Historically, many of these stands were dominated by shade intolerant species maintained by low severity ground fire. Species composition in these stands are a mix of species and size classes with predominantly grand fir, followed by subalpine fir and englemann spruce. Both cover types are over represented on the landscape, while western larch, ponderosa pine, and Douglas-fir are far below historic range of variation (Table 4). Active insects and diseases, primarily dwarf mistletoe and fir engraver, were observed in these stands. Understories are dominated by grand fir and Douglas-fir with pinegrass (*Calamagrostis rubescens*) and elk sedge (*Carex garberi)*. Mortality in most stands is less than 70 % of the overstory. Stand ages range from 59 to 280 years old for trees greater than 9" DBH. Stand cover ranges from 20% to 62% with an average of 38%. Natural disturbance regimes would have created stands with more open structural conditions dominated by large diameter seral species with scattered groups of seedlings and saplings underneath. Current structure in this type is dominated by old forest multi stratum (41%) and understory re-initiation (29%) stage.

**Table 4: Range of variation information for species composition expressed as %**

| Vegetation Cover Type for Moist PVG | Range of variation for cover types (percentages) | Existing range of cover types (percentages) |
|---|---|---|
| Ponderosa Pine | 5 to 15 | <1 |
| Douglas-fir | 15-30 | <1 |
| Western Larch | 10 to 30 | <1 |
| Lodgepole Pine | 25-45 | 5 |
| Grand Fir | 15-30 | 82 |
| Subalpine fir and spruce | 1 to 10 | 13 |

Insects and Management Activities

Insects: The degree of damage from insects is variable and depends upon factors such as species composition, tree size, tree vigor and occurrence of root/bole decays. Mountain Pine Beetle, Western

Pine Beetle, Spruce Beetle, Fir Engraver, Western Spruce Budworm, and Balsam Wooly Adgelid populations have shown a presence in the planning area within the last few years. Stands have pockets of beetle kill, recent attacks and breading populations.

Diseases: Tree diseases cause reduced growth rates, mortality, defect and decay. Incidence and severity of diseases in the Two Eagle area are a combination of vegetation, successional stage, and disturbance (Schmitt, 1994). Major diseases in the area include root diseases, Indian paint fungus, lodgepole cankers, heart rots and dwarf mistletoes. Infected trees can have a reduction in growth, topkill, premature mortality, susceptibility to other biotic agents and predisposition to crown fire (Schmitt, 1996). Overstocked stand conditions increase the risk of further loss of tree species.

Landscape Structure

Fire suppression, fire exclusion and past vegetation management activates have allowed shade tolerant species to invade dry forest sites because surface fire was prevented from fulfilling its role as a tree-thinning process. In moist and cold forest this has caused the loss of widely distributed remnant large and old early seral trees, patches of old forest, and of naturally recovering early successional communities. This has simplified species diversity at patch and larger scales and has transformed forest structure with growth (foliage biomass) shifting downward creating multiple lower layers.

The transformation of vertical structure impacts habitat for all pre-forest, early-, mid-, late-successional and old forest associates, and it is an intensification of disturbance, i.e. understory layers function as ladder fuels, increasing the probability of surface fire transforming into crown fires. Table 5 summarizes the existing range of forest structures in the cold, moist and dry forests. The most notable current conditions include old forest multi-story (OFMS) and understory re-initiation being above the historic range of variation (HRV) while old forest single story (OFSS) and stem exclusion (SE) structures are well below the HRV. Stand initiation (SI) structures are underrepresented in moist and cold forests, and within the range for dry forests.

**Table 5: Two Eagle Existing Stand Structure and HRV by PVG**

| PVG | Existing Acres | % of PVG | Historical Range % |
|---|---|---|---|
| Old Forest Multi Stratum (OFMS) | | | |
| moist upland | 5,073 | 47% | 15-20% |
| dry upland | 2,773 | 41% | 5-15% |
| cold upland | 3,313 | 44% | 10-25% |
| Old Forest Single Stratum (OFSS) | | | |
| moist upland | 131 | 1% | 10-20% |
| dry upland | 212 | 3% | 40-60% |
| cold upland | 0 | 0% | 5-20% |
| Understory Re-initiation (UR) | | | |
| moist upland | 4,091 | 38% | 10-20% |
| dry upland | 1,979 | 29% | 5-10% |

| | | | |
|---|---|---|---|
| cold upland | 2,906 | 38% | 10-25% |
| Stem Exclusion (SE) | | | |
| moist upland | 611 | 6% | 20-30% |
| dry upland | 513 | 8% | 10-20% |
| cold upland | 526 | 7% | 10-30% |
| Stand Initiation (SI) | | | |
| moist upland | 866 | 8% | 20-30% |
| dry upland | 1,322 | 19% | 15-25% |
| cold upland | 854 | 11% | 20-45% |
| Total Acres/PVG<br>Dry<br>Moist<br>Cold | 25,170 | PVG acres are for forested acres within the 39,020 SWS's. | |

Cold Upland Forest
Understory re-initiation (38%), and old forest multi stratum (44%) structures dominate this forest type occurring at levels well above the historic range of variability (HRV). Old forest single stratum, stand initiation and stem exclusion forest structures are currently below the HRV.

Moist Upland Forest
Current structure in this type is dominated by old forest multi stratum (47%) and understory re-initiation (38%) stage occurring at levels well above HRV. Old forest single stratum, stand initiation and stem exclusion forest structures are currently below the HRV.

Dry Upland Forest
Current structure in this type is dominated by old forest multi stratum (41%) and understory re-initiation (29%) stage. Old forest single stratum and stem exclusion forest structures are currently below the HRV, while levels of stand initiation are within HRV for the dry forest types.

*Tree Density*
Published stocking guidelines are used for evaluating stand density levels (Powell 1999). Stand density is a characterization of tree stocking for an area. It expresses the number of stems occupying a unit of land. Stand density provides an index of forest health concerns including and not limited to; competition, fire hazard, beetles and diseases (Cochran et al.1994, Powell 1999).

Tree density classes are defined as follows:

- Low Tree Density – are densities generally within the lower management zone for the species within each PVG.
- Medium Tree Density – are densities generally between the lower and upper management zones for the species within each PVG.
- High Tree Density – are densities generally near or above the upper management zones for the species within each PVG.

**Table 6: Two Eagle Existing Stand Density and HRV by PVG.**

| Stand Density Class (Expressed as basal area, in $ft^2$/acre at 10" QMD | Potential Vegetation Group Range of Variation (Percentage) | | | Current Conditions Range of Variation (Percentage) | | |
|---|---|---|---|---|---|---|
| | Dry UF | Moist UF | Cold UF | Dry UF | Moist UF | Cold UF |
| **Low** (dry: <55; moist: <100; cold: <80) | 40-80 | 20-40 | 15-35 | 6 | 29 | >1 |
| **Moderate** (dry:55-85; moist:100-150; cold: 80-120) | 15-30 | 25-60 | 20-40 | 31 | 40 | 21 |
| **High** (dry:>85; moist: >150; cold: >120) | 15-May | 15-30 | 25-60 | 63 | 31 | 79 |

**Desired Future Condition**

The desired future condition is to have a mosaic of structural stages across the Two Eagle planning area within the historical range of variation and to use the natural disturbance regime as a template to manage for structure, density, and species compositions across the landscape that are sustainable. Forest stands would be distributed across the landscape in varying size patches exhibiting different ages, structures, densities and compositions providing a mixture of forage and thermal cover areas for big-game, and late-seral structures and habitat for old-growth dependent species.

Irregular spaced forest stands with individually spaced trees, and large and small openings would create variations in the fuel beds and limit the potential for crown fire initiation and spread and help reinforce post-fire vegetation patterns. The tree stocking and species composition would be consistent with historical disturbance patterns and managed at levels to prevent uncharacteristic insect and disease outbreaks. Varying within-patch structure and composition would also help hinder bark beetle mass attacks by breaking up susceptible host, tree sizes and ages.

Silviculture treatments would create stand structures in patches and arrangements that enhance resiliency to future disturbances. Historical range of variation information would guide treatment as it provides an understanding of how interacting fire and climate influenced ecological patterns of forest structure and successional conditions. The presence of large, old trees of early seral species would be essential in this project area as they have higher resiliency to disturbance such as drought or fire, and will help maintain species diversity. Large diameter (greater than 20 inches) down woody debris and standing snags would be retained.

**Conclusion**

The harvest, cultural, and post-sale activities would allow for an opportunity to maintain or increase the structural diversity, in the analysis area and achieve the desired future condition. Silvicultural prescriptions result in maintaining or regenerating a mixture of tree species appropriate for each site, as well as, managing density levels at appropriate numbers.

## SILVICULTURAL EFFECTS OF THE ALTERNATIVES

**Introduction**
There are several factors in the Two Eagle Analysis Area that affect overall integrity as described by the Watershed Restoration and Prioritization Process (WRAPP) developed by the Wallowa-Whitman National Forest (2002). Stressors indicated by WRAPP include Fire Regime, Insect and Diseases, Noxious Weeds, Road/ Stream Connectivity, Road/ Wildlife Security. The Risk of fire and insect and disease are major silvicultural concerns to implementing the Wallowa-Whitman Forest Plan and ecosystem management. To restore and maintain the landscape, silvicultural means should be used to modify and rejuvenate the forested landscape in the analysis area.

**Analysis Assumptions**
The project area is approximately 36 air miles from La Grande, Oregon. The 7,206 acres of project area is the analysis area for assessing direct and indirect effects. The cumulative effects analysis includes subwatersheds: Bennet creek-Eagle creek, Upper Eagle creek, and West Eagle creek.

To restore and maintain the landscape, silvicultural treatments can be used to modify forest structure, composition, and density to rejuvenate the forested landscape in the analysis area. Tree harvest prescriptions such as Improvement cuttings or commercial thinning are types of silvicultural methods that can improve landscape health, reduce the risk of insects, diseases, and wildfire (Powell 1999, Graham et.al. 1999, Millar et. al. 2007, Kimbell 2007, Brown 2008, Strategic Framework 2008). Treatments can provide a range of structures for the long term, release potential of the sites, and alter species composition. If a landscape can be maintained within RV, then they stand a good chance of maintaining their biological diversity and ecological integrity through time (function) (Powell 2010).

Insects and diseases can cause tree growth reduction, mortality, defect and decay. On an ecosystem health basis, a certain level of tree insect/disease activity is expected (Schmitt 1994) and desirable to support wildlife (Bull et al. 1997). Trees may be susceptible to attack by insects or diseases by various factors including fire, overstocking, drought conditions, and the existing level of insects and diseases within the area. Stand density is one of the most important factors influencing certain insect populations; dense stands increase tree competition, which increases stagnation and development of a suppressed class of trees, which can lead to outbreaks (Scott 1996, Powell 1999). Another important factor to spread of insects/diseases is species composition. Current philosophy is to manage the level of insects/diseases and their effects, to within the range that is believed historical (Schmitt 1994). Most root diseases are believed to have increased in their virulence and occurrence in the Blue Mountains (Schmitt 2001).

Many stands in the Two Eagle Planning Area have suppressed and intermediate trees where stocking levels exceed recommended numbers (from Powell, 1999) in stands across all potential vegetation groups. Overstocking and poor tree conditions can lead to an increase in beetle populations, reduced health of the stand, decreases in production of both the overstory and understory, and altered stand structures and compositions. In many instances stress, particularly drought stress, is compounded by overstocking (Fiddler et al., 1995). Appropriate stocking levels can help to increase tree growth and fire, insect, disease resistance of stands (Lambert 1994). The number of stands treated would measure the effectiveness of the alternatives towards reducing stand density and changing species composition.

According to the Intergovernmental Panel on Climate Change, there has been a clear pattern of temperature increases and long-term trends in precipitation changes (Kimbell 2007). The panel concludes that disturbances from pest, diseases and fire are projected to have increasing impacts on

forests. Climate change most typically is predicted to increase fire, drought, and greater vulnerability to insects and diseases in forests (Brown 2008). Insect life cycles are highly sensitive to temperature; climate change can have a large impact on the development, survival, and distribution of insects (Redmond 2007, Brown 2008). Recent warming trends have caused mountain pine beetle infestations in areas that have not previously recorded outbreaks in British Columbia and this increase has occurred largely in part due to a shift in climate (Carroll 2004, Beukema et.al. 2007).

The impacts of climate change on most terrestrial ecosystems are expected to occur at a rate that would exceed the capacity of many plant and animal species to migrate or adapt (Kimbell 2007; Strategic Framework 2008) and create forests that are ill adapted to conditions and more susceptible to undesirable changes (Millar et. al. 2007). To restore and maintain the landscape, silvicultural means should be used in the project area to modify and rejuvenate the forested landscape, improve landscape health, reduce the risk of insect mortality and wildfire, begin to provide a range of structures for the long term, release potential of the sites, and alter species composition (Millar et. al. 2007, Kimbell 2007, Policy Statement 2007, Brown 2008, Strategic Framework 2008, Science Findings 2016).

Prescriptions discussed in this document and used in timber stand treatments are as follows:

**WFM-Fuels reductions with commercial removal.** In the event of a future biomass market supporting commercial removal, this treatment would reduce ladder and ground fuels using commercial biomass removal to accomplish fuel reduction objectives. Canopy bulk density would also be reduced using a commercial thinning from below prescription with additional slash busting, whip falling or pre-commercial thinning post-harvest to achieve fuel reduction objectives.

**HIM- Improvement Harvest:** This prescription includes cutting that is made with the purpose of:

1. Decreasing competition for residual trees left in the stand (spacing distribution)
2. Altering species composition (increase early seral species composition, i.e. Western larch)
3. Altering structure (i.e. Old Forest Multistory (OFMS) to Old Forest Single Story (OFSS) for dry stands)
4. Increasing quality (growth form, i.e. removing trees of undesirable species, form or condition from the main canopy)

Trees of different size classes would be retained throughout the stand. An emphasis would be made to retain fire and drought tolerant trees (Douglas-fir (*Pseudotsuga menziesii*), western larch (*Larix occidentalis*), and ponderosa pine (*Pinus ponderosa*)) of medium and large diameters to provide a backbone of wildfire and climate-tolerant landscapes while providing for essential components of wildlife habitat.

This prescription would reduce the stocking level to the lower management zone (LMZ) for associated plant groups (Powell, 1999). Reducing stocking levels below LMZ would occur when stands have high amounts of insect and disease disturbance, with few trees displaying a live crown ratio greater than 30-40%, and a mostly suppressed understory; or stands that have soil evidence that supports lower stocking rates.

Cutting intensity would vary for different areas dependent on both biotic and abiotic factors. This prescription creates a natural visual appearance by moving conditions toward its historical range, opening stands to a lower stocking level, and toward a species composition that is within the historical range. The effort to move conditions toward the historical range usually contributes to the improvement of scenic stability and wildlife habitat.

**HPO-Patch openings:** Partial openings harvest would occur in stands that are predominately lodgepole pine with some associated species, the objective in these stands is to take approximately 10% of the stand and create small holes that would promote early successional structure and early seral species such as western larch and ponderosa pine, as well as creating some heterogeneity in stands. The remainder of the unit is a matrix of thinned areas and reserves. Patch openings are shaped and blended to the extent practicable with the natural terrain. Tree density in thinned areas would be decreased to the associated plant association group's LMZ. Treatment is designed to create small canopy openings, an individual gap may get as big as 4-6 acres in size, to improve a stand's resilience to insect and disease outbreaks by creating heterogeneity in the stand. In addition, this prescription would create favorable conditions, i.e. more sunlight, for regeneration of western larch and ponderosa pine and decrease the amount of grand fir. The patch openings would replicate patterns that appear on the natural landscape; gaps would be similar in size, shape and form which introduces visual diversity to the scene. This is the case especially where the characteristics of the openings borrow form or repeat nearby patterns, such as wildfire burn scars (Bradley 1996). Patch treatments would create forests with canopy openings that reflect fine-scale disturbances and increase resilience to insects, disease, wildfire and climate change (Graham et al. 2004). Any harvest which would reduce stocking below the minimum crop tree stocking level would be considered a regeneration harvest. They would, therefore, require provisions for establishing new stands and be subjected to created opening constraints. Reforestation methods, artificial or natural, would be made on a site-by-site basis. Natural regeneration would be considered and surveyed three times within the first five years to insure adequate restocking is met. Planting would be considered if restocking is not met after five years or if natural regen is dominated by less resilient species to insects, disease and drought.

**Commercial Thinning:** Tree density across thinned areas would be a matrix of areas cut to the lower management zone (LMZ), cut to the upper management zone (UMZ), or somewhere in-between. Thinning would emphasize tree selection rather than spacing by using basal area. Churchill et al. (2017) demonstrated this would help achieve the target range of variability. Thinned areas would create or maintain openings, clumps or individuals. The best quality trees would remain on the site. Ladder or ground fuels or suppressed intermediates/co-dominants would be removed to reduce competition (Seidel, 1980).

**HCR-Seed Tree:** All trees would be removed except mature trees of a desired species that would help provide seed for establishing a new stand.

One acre is proposed for this treatment, which is located on a moist stand. The stand overstory is dominated by cottonwood. Grand fir has encroached into the stand and now prevents any new cottonwood regeneration from becoming established. Cottonwood (*Populus trichocarpa*) would eventually lose dominance of the stand to shade tolerant species without treatment. Treatment would produce enough visible sky that would enable cottonwood to be competitive

and ground base logging would cause ground disturbance causing cottonwood to sprout (Johnson, P. 1989).

**Riparian Habitat Conservation Area Patch (RHCA) Openings:** Cutting would be restricted primarily to hand treatment inside a unit; tree removal would be allowed where the equipment does need to leave a specified road. Commercial equipment would reach into RHCAs to fell and remove trees with near total suspension. Felled trees out of reach of mechanized equipment would be lopped and scattered. Treatment would remove all co-dominant trees around dominant and co-dominant ponderosa pine, western larch Douglas-fir or cottonwood inside RHCAs. Gaps would not exceed roughly 2 dripline radius in size or an average of 20 feet from the center of the tree. No more than 5 gaps per acre would occur. RHCA Patch Opening Treatment (HPO) contribute to ecosystem stability by reducing stand densities and removing ladder fuels that put riparian areas at risk for wildfires that burn with characteristics beyond those of fires within the historical range. This treatment would move the stand toward a historical representation of species composition; e.g. more cottonwood present. The effect of this prescription does not reduce the scenic integrity.

**PCT- Precommercial thinning:** Thinning of smaller diameter selected trees in a young stand to stimulate the growth of the remaining trees. Cutting may be accomplished by manual or mechanical (slash buster) methods. The primary effect of early PCT work would be to control whether wood volume and growth are concentrated on few large, stable trees or spread over many small, unstable trees (Schaedel et al.2017). The positive effects of PCT are similar to thinning, however, no commercial products would be removed. The negative effects to scenery are limited to foreground view effects of stumps and slash. Slash may be treated through slash busting, hand-piling and burning which reduces the visual effects to the casual viewer, or is lopped up into small sections and scattered throughout the stand at an average height of 2' above the ground to help with nutrient cycling. Pre-commercial thinning contributes to scenic stability by reducing stand densities and removing ladder fuels that put scenic attributes at risk to potential wildfires.

**RWF-Whip felling:** Cutting would be restricted to hand treatments only that focus on felling co-dominant or ladder fuels surrounding desirable overstory species. This helps decrease the risk of mortality from wildfire outside of its historical range. These fuels would be lopped into smaller sections. This prescription could be used in conjunction with a prescribed burn.

**Mule Deer Habitat Restoration Meadow Enhancement:** Meadows inside the Two Eagle project area are overrepresented with lodgepole pine and grand fir. This occurs naturally when disturbances, such as fire, are absent from a site. A mineral seedbed in a well-lit, warm, moist environment favors seed germination. Early snowmelt and long snow-free periods also favor seedling establishment. (Ratliff, 1985). These meadows adapted with fire. Light fires, which only burn the current growth, do little harm to trees or meadows. Hot fires however, which burn mulch and peat, may kill well-established trees and greatly damage meadows. (Ratliff, 1985)

27 acres inside the Two Eagle project area, are meadows currently receding in size due to ingrowth of lodgepole pine and grand fir. These meadows provide important habitat for early spring calving for mule deer. Restoration work to decrease encroachment of conifers into meadows and reduce hot fire risk is warranted. Meadow enhancement would include area within Riparian Habitat Conservation Area for Eagle creek. Treatment would range from 80'- to

over 300' feet away from Eagle creek, outside the RHCA area. All cutting would be performed by hand, with the purpose of removing lodgepole pine and grand fir under 9 inches diameter at breast height (DBH) inside identified areas. Trees greater than 9 inches DBH would be retained in the meadow. Slash would be bucked up into smaller sections and scattered, or piled and burned at a later date; or used for stream restoration wood debris projects. No trees within 80 feet of Eagle Creek would be cut. Stumps would be cut low to reduce visual ethics. Removing encroaching conifers would restore meadow functions and improve habitat quality for deer.

**Table 7: Comparison summary of alternatives**

| ALT | Total Acres | Volume (MMBF) | Prescriptions (Acres) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | HIM | HTH | HPO | RHCA-HPO | HCR | WFM | NCT |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 2,533 | 7.0 | 1,116 | 348 | 35 | 7 | 1 | 0 | 1,026 |
| 2 MOD | 2,576 | 7.0 | 1,116 | 348 | 35 | 7 | 1 | 362 | 707 |
| 3 | 2,072 | 5.6 | 818 | 313 | 35 | 0 | 1 | 0 | 905 |

*Note: HIM- Improvement harvest, HTH-Commercial thinning, HSH- Shelterwood harvest, HPO- Patch openings harvest, RHC-HPO- Patch openings harvest in RHCA; HCR- Seed tree harvest, WFM- Biomass removal; NCT- Non-commercial treatments (pre-commercial thinning, whipfelling by hand, mechanical whipfelling/ mastication and fuels reduction)

**Effects Analysis**

Alternatives considered:

**Alternative 1:** This alternative is the no action alternative and is consistent with NEPA regulations.

**Alternative 2:** This alternative is designed to alter stand densities, structures, and composition to improve overall tree vigor and ability of trees to withstand forest pest, insects and drought. This alternative treats stands to improve fire resistance, improve tree vigor and growth, reduce competition, and minimize losses to insects and disease.

**Alternative 2 modified:** This alternative is designed to respond to comments from scoping. In general it is similar to alternative 2, but also considers commercial removal of biomass from non-commercial units and adds in noncommercial meadow enhancement treatments to promote wildlife habitat.

**Alternative 3:** This alternative is designed to respond to comments from scoping. In general, all treatment units, commercial or non-commercial, inside moist or cold stands outside of the Eagle Creek/ Tamarack Wildland Urban Interface were dropped. Additionally, all RHCA and meadow enhancement treatments were dropped.

## Direct and Indirect Effects on Forest Health and Sustainability

Vegetation within each PVG reflects the integration of ecosystem components called composition, structure, and process (function). Composition refers to the relative abundance of ecosystem

components, structure refers to the physical arrangement of composition in an ecosystem and function refers to the processes through which composition and structure interact.

In this analysis we included the current condition of three components for each PVG: species composition, forest structure and stand density and compare it to the range of variability (RV).These components provide an understanding of how interacting fire and climate, and their variability through time and space, influenced ecological patters of forest structure and successional conditions (Hessburg et. al. 2016). This information determines a landscape's susceptibility to disturbances; insects, disease, and fire and therefore its degree of resiliency. Resiliency is defined as the ability of a social or ecological system to absorb disturbance while retaining the same basic structure and ways of functioning.

The key indicators for analysis of long term forest health are:

- Acres of overstocked stands treated within the project area to recommended stocking levels (Powell, 1999)
- Acres where species composition are trending towards HRV for species composition
- Acres where structural composition are trending towards HRV for structural composition

**ALTERNATIVE 1- No Action**

Under this alternative no stands would be treated; therefore, stocking levels, species compositions, and structural stages would remain unchanged. Alternative 1 would do nothing to mitigate the accumulation of fuels or restore ecosystem sustainability that includes the re-establishment of inherent disturbance regimes objective. Fire behavior indicated by rate of spread and intensity would remain unchanged until a wildfire occurs. There would be an increased risk of high-intensity wildfire through continued build-up of dead fuels. In addition to killing surviving trees and other vegetation, intense wildfire can damage the site and contribute to severe scouring of streams during peak run-off events. With this alternative an increase in multi-layering within stands and susceptibility to crown fires, spread of root diseases, dwarf mistletoe and risk of future tussock moth and western spruce budworm defoliation is anticipated. Objectives of maintaining healthy and vigorous stands capable of resisting successful insect and disease attacks would not be realized.

Cold Upland Forests
This group is very susceptible to fires and can sustain stand replacement fires. Lodgepole pine, which in many areas is a major component of this type, is susceptible to mountain pine beetle infestation which is currently causing mortality in stands. There is an ongoing increase of balsam wooly adelgid affecting the subalpine fir in this vegetation group. Under this alternative over 59% of this forest type would remain with high stocking densities. The amount of grand fir would be over-represented while the amount of western larch would be under-represented.

Moist Upland Forests
In moist upland forests, density related mortality would continue to increase and much of the understory component would be suppressed. Many of these stands would remain in a condition of low vigor which increases the risk of insect and disease attack or damage and reduces growth potential. Competition would also have a negative effect on the vigor of larger stand components contributing to increased mortality. Early seral species such as western larch, would lose dominance to shade tolerant species in partial shade (Fowells and Stark, 1965).

Fire and insect/disease risks would not be reduced. Under this alternative, stands in the group would experience an increased spread of insect and disease (particularly root disease) damage and wildfire. Without introducing some partial openings into the stands the movement towards more seral species would be delayed until a stand disturbing event creates conditions that enable seral species to develop. Under this alternative over 68% of this forest type would remain with high stocking densities with overrepresented quantities of grand fir and underrepresented quantities of Douglas-fir, ponderosa pine and western larch.

Dry Upland Forests
In these stands, fir would continue to occupy parts of the stands reducing the regeneration of seral species. Without some type of disturbance these stands would continue to have an excessive fir component not historically present in this vegetation group. If left untreated, these stands would continue to exhibit reduced growth rates and become more susceptible to disease and insect related mortality. Fire and insect/disease risks would not be reduced and fuel loadings would continue to accumulate and contribute to higher fire intensities than those that would have occurred historically. The no action alternative strategy accepts the risk of high-severity wildfire and other uncharacteristic disturbance events (Powell, 2014). Under this alternative over 41% of this forest type would retain high stocking densities. The amount of grand fir, lodgepole and Douglas-fir would remain overrepresented, and the amount of ponderosa pine would be underrepresented.

This alternative would result in a continued decline in overall forest health as described by stand and tree health, as well as an increase in potential fire intensities. The risk of losing these stands to mountain or western pine beetle would increase. Additional growth to trees would not be realized and movement towards larger diameter trees delayed. The desired future health and sustainability of the forest is not considered with this alternative. In all vegetation groups when species composition is outside of historic ranges as described above, resiliency is reduced making the landscape less resistant to disturbances such as insects, diseases, wildfire, and climate change impacts.

**ACTION ALTERNATIVES**
Alternatives 2, 2 modified and 3 are a combination of partial openings, commercial thinning, improvement harvests, seed tree regeneration harvest, release treatments, fuels reduction activities, prescribed fire, and artificial and natural regeneration. Of the 7206 acre project area approximately 6,236 acres are forested (86.5% of the project area). There are 2,222 acres in reserved lands such as allocated old growth and riparian buffers (30.8 % of the project area). Of the non-reserved forested acres, 1966 acres (48.9% of the available forested acres) have received a commercial entry and 953 acres (23.6% of the available forested acres) have had a non-commercial treatment in last 50 years. (Table 6)

**Table 6 – Percentage of Treatments across the Planning Area**

| Alternatives | Total Acres Treated | % of total Available Acres Treated | Commercial Acres Treated | % of Available Acres Treated in 2 Eagle-Commercial | % of Commercial Acres Occurring in Previously Treated Stands (Last 50 yrs) |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | 2,533 | 63 | 1,507 | 38 | 31 |
| 2 Modified | 2,576 | 64 | 1,869 | 47 | 33 |
| 3 | 2072 | 52 | 1,167 | 29 | 24 |

Where applicable, action alternatives would create conditions that:

- favor establishment of multi-storied stands
- revert old forest multi storied stands to old forest single storied stands
- favor establishment of larch and pine
- remove ladder fuels and reduce crown densities
- reduce densities and alter species composition

Current prescriptions focus on managing stands within a range of desired densities. The lower range or LMZ would maintain stocking at a point where a significant portion of the site resources are captured in tree growth. The upper range of density or UMZ prevents the establishment of a suppressed tree class to develop. Stands near or above the UMZ are more likely to develop stress, be less vigorous and contain more mortality.

Reforestation is expected to occur more quickly with the action alternatives, due to reforestation activities such as planting and adequate site preparation in comparison to the no action alternative. Created openings would remain for 10-15 years in treated stands. Woody debris would be left on the site to contribute to the nutrient cycling (long term site productivity) and enhancement of small mammal habitat. Stands not treated in the action alternatives would experience similar effects to those described in Alternative 1.

**Species composition**

Species composition, as represented using forest cover types, is expected to change in response to implementation of silvicultural activities proposed for the action alternatives. Most of the forest cover types affected by implementation of silvicultural activities are late-seral (grand fir and spruce-fir), and they are decreased as an effect of implementation; early- or mid-seral cover types (ponderosa pine, Douglas-fir, and western larch) are either enhanced or established by these alternatives, so they are increased as a consequence of implementing the action alternatives (Table 7-9).
Tree Species Composition

Cold Upland Forest Group

**Table 7: Change in Cover Type by Alternative for Cold PVG**

| Vegetation Cover Type for Cold PVG | Range of variation for cover types (%) | Existing range of cover types (%) | Alt 2 | Alt 2 Mod | Alt 3 |
|---|---|---|---|---|---|
| Ponderosa Pine | 0-5 | <1 | 4 | 4 | 2 |
| Douglas-fir | 5 to 15 | <1 | 10 | 10 | 5 |
| Western Larch | 5 to 15 | <1 | 11 | 11 | 8 |
| Lodgepole Pine | 25-45 | 48 | 35 | 35 | 40 |
| Grand Fir | 5 to 15 | 19 | 14 | 14 | 16 |
| Subalpine fir and spruce | 15-35 | 33 | 26 | 26 | 31 |

All commercial harvest treatments in this PVG would focus on protecting and restoring large and old, early successional tree abundance where environmental conditions clearly support low and mixed-severity fire regimes. This can be identified where there are large and old early seral species in a stand. Treatment involves at a minimum removing (where feasible) fuel ladders and heavy surface fuels form their immediate vicinity, and the broader surrounding landscape. Early seral species where present would be managed at fire-resistant densities, resulting in spatial variability of patches. This treatment is

an example of a typical thinning (HTH) prescription. Variable density thinning would increase growth rates of remaining trees, accelerates the development of more fire resilient boles and crowns, and creates spatial variability to break up fuel continuity against crown fire spread and of susceptible host trees to insects. Reducing sub-alpine fir and grand fir species composition would be the primary focus of this treatment.

Pre-commercial thinning (PCT, RWF, WFM) follows the same management guidelines, but targets smaller diameter classes of trees. Western Larch and ponderosa pine would be the desired species to retain followed by Douglas-fir and lodgepole pine. Late-seral species, sub-alpine fire would not be left unless they are providing critical habitat or are greater than 21"DBH.

Gap openings (HPO) occur where areas that are lacking large and old early seral species distribution. Gaps will be sufficiently large enough to facilitate in regenerating new vigorous cohorts of early seral species, such as western larch. Gap placement would be strategically placed to facilitate natural regen of early seral species, or serve as a fuel break. This would involve leaving residual early seral species inside of gaps or on gap edges to help seed-in gaps. Planting desired species would be required in some instances to ensure successful establishment. In the two eagle project area, lodgepole pine dominated stands ideally fit this type of treatment; species composition after treatment would represent more early seral species and less subalpine fir and lodgepole pine.

Each treatment HTH, WFM or WFH, HPO would generate logging slash that can increase sever fire behavior. Treating surface fuel accumulation is an essential part of reducing risk of sever fires. Whole tree harvesting has the advantage of leaving limited activity fuels behind and would be utilized in areas that is operationally feasible or will degrade future site productivity. Following harvest treatment, prescribe broadcast burning or pile burning would be implemented to facilitate site preparation for establishing early seral species and reduce fuel loading.

Moist Upland Forest Group

**Table 8: Change in Cover Type by Alternative for Moist PVG**

| Vegetation Cover Type for Moist PVG | Range of variation for cover types (%) | Existing range of cover types (%) | Alt 2 | Alt 2 Mod | Alt 3 |
|---|---|---|---|---|---|
| Ponderosa Pine | 5 to 15 | <1 | 8 | 8 | 5 |
| Douglas-fir | 15-30 | <1 | <1 | <1 | <1 |
| Western Larch | 10 to 30 | <1 | 25 | 25 | 18 |
| Lodgepole Pine | 25-45 | 4 | 3 | 3 | 3 |
| Grand Fir | 15-30 | 57 | 55 | 55 | 65 |
| Subalpine fir and spruce | 1 to 10 | 9 | 10 | 10 | 10 |

Thinning (HTH) treatments for this PVG would shift species towards more fire and drought tolerant western larch, ponderosa pine and with a lesser representation of Douglas-fir, grand fir and Engelmann spruce; similar to treatment objectives in cold PVG. Residual trees would be healthy, vigorous and display live crown ratios (LCR) of greater than 35%. Implementing this prescription would involve protecting early seral trees over a minimum size by removing ladder fuels of shade-tolerant species within the distance of two driplines from residual trees.

Improvement harvest (HIM) would shares the similar goals as HTH where it would shift species composition to more drought and fire tolerant species. Treatment would also focus on removing disease

infested trees, reducing the amount of disease inside of a stand and promote species that have higher resiliency to the disease or is not susceptible to the disease present. Two examples of this type of strategy would include managing for early seral species where grand fir has encroached into stands and is infected with Annosus root disease; and removing infected species with dwarf mistletoe and managing for a different species around known trees infected dwarf mistletoe to reduce mistletoe spread. Openings would result from this type of treatment where diseases is present and would create conditions that encourage regeneration of early seral trees, shifting growing conditions that currently encourage shade tolerant species.

Following harvest treatment prescribe broadcast burning or pile burning would be implemented to facilitate in site preparation for establishing early seral species and reduce fuel loading.

Dry Upland Forest Group

**Table 9: Change in Cover Type by Alternative for Dry PVG**

| Vegetation Cover Type for Dry PVG | Range of variation for cover types(%) | Existing range of cover types (%) | Alt 2 | Alt 2 Mod | Alt 3 |
|---|---|---|---|---|---|
| Ponderosa Pine | 50-80 | <1 | 21 | 21 | 27 |
| Douglas-fir | 5 to20 | 2 | 1 | 1 | 1 |
| Western Larch | 1 to10 | <1 | 9 | 9 | 9 |
| Lodgepole Pine | 0 | 0 | 1 | 1 | 1 |
| Grand Fir | 1 to 10 | 66 | 37 | 37 | 61 |
| Subalpine fir and spruce | 0 | 1 | 1 | 1 | 1 |

Thinning treatments (HTH and HIM) in this PVG would reduce grand fir representation, as it is over represented on the landscape. Early seral species that are disease free and have a live crown ratio of greater the 35% would be protected and promoted, typically promoting western larch, then ponderosa pine and then Douglas-fir. Treatment would result in healthy and vigorous early seral residual trees with live crown ratios (LCR) of greater than 40% and exhibit more open conditions dominated by ponderosa pine and western larch. Shade tolerant species would not be left inside treated areas for this PVG regardless of treatment type (WFM, RWF, HIM, HTH) unless they are greater than 21" DBH or providing wildlife habitat as they are overrepresented on the landscape. HIM treatments would create gaps in harvest units where shade-tolerant species dominate or desired residual trees are infested with disease such as mistletoe. Gaps would be large enough to favor regeneration of early seral species. Following harvest treatment, as with the other PVG, prescribe broadcast burning or pile burning would be implemented to facilitate in site preparation for establishing early seral species and reduce fuel loading.

**Stand and Landscape Structure**

Under Alternative 2, 2 modified and 3 are generally expected to follow the structural change model in the next 20-50 years: UR to OFSS, SI or SE; OFMS to OFSS, SE to SI.

Proposed commercial treatments either thinning (HTH) or Improvement harvest (HIM) within dry, moist and cold forest types include 394 acres treatment of OFMS Alternatives 2 and 2 modified, 384 acres for alternative 3 with the intent to restore OFSS stand structures (which are severely deficient in all forest

types). 701acres of treatment to maintain OFMS, and 763 acres of treatment of UR structures aimed at promoting development of future large tree structures of both OFMS and OFSS.

Alternative 2 proposes an estimated 1116 acres of improvement treatment and 348 acres of thinning in both UR and OFMS. In addition alternative 2 modified includes 106 acres of biomass removal, alternative 2 includes biomass removal units in PCT and RWF treated areas. Alternative 3 proposes an estimated 818 and 313 acres of improvement harvest and thinning respectively. Treatments (HTH or HIM) would result high vigor residual trees in stands in the understory re-initiation or stem exclusion structural stage would promote development of stands into the old forest single (OFSS) and multi-stratum (OFMS) through increased diameter growth rates of residual trees (Cochran & Seidel, 1999; Cochran & Dahms, 1998). Canopy openings or gaps would result in HTH or HIM treatments where groups of low vigor trees were removed, creating horizontal and vertical complexity in the stand and helping stands establish more seral species which are underrepresented on the landscape.

Treatments (HTH and HIM) in current OFMS would reduce canopy cover below 45%, by retaining large diameter trees, removing ladder fuels around larger early seral trees, and decreasing the amount of late seral species on the stand, and breaking up the continuity of the overstory canopy. Depending on the stand, treatment in some OFMS would remain as OFMS due to presence of a heathy overstory and manageable intermediate and understory trees. In these cases, some co-dominant trees less than 21" diameter at breast height (DBH) would be removed based on poor form, low vigor and/or disease, however the thinning would retain midstory and understory trees retaining OFMS condition. Stands that would remain OFMS, typically would not have a large component of early seral species (ponderosa pine and western larch) inside the stand. In addition, late seral species such as grand fir or englemann spruce present in these stands would be left at higher densities to maintain high canopy cover.

Alternative 2 and 2 modified is estimated to restore 6% of the dry PVG OFMS to OFSS, 1% of moist and cold PVG OFMS to OFSS. No commercial treatment within existing limited OFSS stands are proposed. Alternative 3 is estimated to restore 2% of OFMS to OFSS. No Moist OFMS would be restored to OFSS in Alternative 3.An estimated 172 acres of non-commercial treatments are proposed within OFMS for alternative 2 and 2 modified. Alternative 3 would have 137 acres within OFMS. Canopy cover would not change significantly (<45%) with these treatments and the treatments would maintain stands in their current OFMS structure. Down wood would be retained at forest plan levels but reduction of down fuel levels will reduce available habitat for some small mammals and hiding cover for young ungulates and mustelids.

Patch opening and seed tree prescriptions (HPO and HCR) would occur on 36 acres for all the alternatives in UR. These openings occur in cold forest dominated by late seral species such as subalpine or grand fir or lodgepole pine. The intent of these patches are to create SI structure openings for early seral regeneration. Planting would be required in areas where no early seral species are found to help establishment. Openings would be strategically placed around existing early seral species to help facilitate natural regeneration. Gaps would vary within- patch structure creating variation in fuelbeds that limit the potential for crown fire initiation and spread. Gaps would also help disrupt chemical signaling among bark beetles inhibiting mating and breaking up the stands continuity of susceptible host, tree sizes and ages (Hessburg et al. 2016). Openings would occur inside the stand where low vigor trees were removed, creating greater horizontal and vertical complexity in the stand; along with moving

stands towards more seral species which are underrepresented on the landscape. In addition gaps would create greater horizontal and vertical complexity in the stand.

Cold Upland Forest Group

**Table 10: Pre- and Post-Treatment Forest Structural Stages for Cold PVG in percentage for Alternatives 2, 2 modified, and 3**

| | | | Estimated Impacts | | |
|---|---|---|---|---|---|
| Forest Structural Stage For Cold PVG | RV values | No Action (%) | Alt 2 (%) | Alt 2 Modified (%) | Alt 3 (%) |
| SI: Stand Initiation | 20-45% | 11 | 12 | 12 | 12 |
| SE: Stem Exclusion | 10-30% | 7 | 7 | 7 | 7 |
| UR: Understory Re-initiation | 10-25% | 38 | 35 | 35 | 36 |
| OFSS: Old Forest Single Stratum | 5-20% | 0 | 3 | 3 | 1 |
| OFMS: Old Forest Multi-strata | 10-25% | 44 | 43 | 43 | 44 |

Stand initiation is estimated to increase with all alternatives due to the gap opening (HPO) and seed tree (HCR) treatment in UR cold PVG stands. OFSS is estimated in the next 20-50 years to be created through treating UR and a minor component of OFMS with HTH and HIM treatments.

Moist Upland Forest Group

**Table 11: Pre- and Post-Treatment Tree Forest Structural Stages for Moist PVG in in percentage for Alternatives 2, 2 modified, and 3**

| | | | Estimated Impacts | | |
|---|---|---|---|---|---|
| Forest Structural Stage For Moist PVG | RV values | No Action | Alt 2 (%) | Alt 2 Modified (%) | Alt 3 (%) |
| SI: Stand Initiation | 20-30% | 8 | 8 | 8 | 8 |
| SE: Stem Exclusion | 20-30% | 6 | 6 | 6 | 6 |
| UR: Understory Re-initiation | 10-20% | 38 | 34 | 34 | 37 |
| OFSS: Old Forest Single Stratum | 10-20% | 1 | 6 | 6 | 3 |
| OFMS: Old Forest Multi-strata | 15-20% | 47 | 46 | 46 | 47 |

OFSS is estimated in the next 20-50 years to be created through treating moist PVG UR with HTH and HIM prescriptions. OFMS is estimated to be maintained with HTH and HIM treatments that maintain a canopy cover of greater than 45% and lack the old, large early seral species component.

Dry Upland Forest Group

**Table 12: Pre- and Post-Treatment Tree Forest Structural Stages for Dry PVG in in percentage for Alternatives 2, 2 modified, and 3**

| | | | Estimated Impacts | | |
|---|---|---|---|---|---|
| Forest Structural Stage For Dry PVG | RV values | No Action | Alt 2 (%) | Alt 2 Modified (%) | Alt 3 (%) |
| SI: Stand Initiation | 15-25% | 19 | 19 | 19 | 19 |
| SE: Stem Exclusion | 10-20% | 8 | 8 | 8 | 8 |
| UR: Understory Re-initiation | 5-10% | 29 | 25 | 25 | 26 |
| OFSS: Old Forest Single Stratum | 40-60% | 3 | 13 | 13 | 8 |
| OFMS: Old Forest Multi-strata | 5-15% | 41 | 35 | 35 | 39 |

Intermediate treatment (HTH and HIM) in dry OFMS stands is expected to restore OFSS stand structures in stands that naturally experienced frequent low intensity surface fires. Intermediate treatments in Dry PVG UR stands is expected to create OFSS which would help increase representation of OFSS conditions that are below HRV for the Two Eagle project area.

**Tree Density**

Tree density classes are expected to change in response to implementation of silvicultural activities proposed for the action alternatives. Implementing the silvicultural activities is expected to cause a consistent reduction in tree density for the treatment units to either the moderate or low-density condition after implementation. Treated acres would move into the Low to Medium tree density classes reducing competition for site nutrients and improving tree vigor in the mid-term (15-20 years).

Intermediate treatments in all alternatives (improvement and commercial thinning, pre-commercial thinning [WFM or PCT]) for all PVG's would remove suppressed trees around healthy, disease-free, early seral or mid seral species. Trees with poor live crown ratios (less than 35%), evidence of insect attacks or disease would be removed first. Density would be reduced to the lower management zone of the preferred species by plant association group as derived by Powell 1999. Managing for the preferred species with lowest max SDI value on a site ensures that growing conditions favor preferred species.

**Table 13: Pre- and Post-Treatment Tree Densities in percentage for Alternatives 2, 2 modified, and 3**

| Stand Density Class (Expressed as basal area, in ft2/acre at 10" QMD) | Potential Vegetation Group Range of Variation (%) | | | Current Conditions (%) | | | Alternative 2 (%) | | | Alternative 2 Modified (%) | | | Alternative 3 (%) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **D** | **M** | **C** | **D** | **M** | **C** | **D** | **M** | **C** | **D** | **M** | **C** | **D** | **M** | **C** |
| Low (dry: <55; moist: <100; cold: <80) | 40-80 | 20-40 | 15-35 | 6 | 29 | <1 | 44 | 40 | 17 | 44 | 40 | 17 | 36 | 38 | 17 |
| Moderate (dry:55-85; moist:100-150; cold: 80-120) | 15-30 | 25-60 | 20-40 | 31 | 40 | 21 | 26 | 35 | 21 | 21 | 35 | 21 | 31 | 40 | 21 |
| High (dry:>85; moist: >150; cold: >120) | 5- 15 | 15-30 | 25-60 | 63 | 31 | 79 | 30 | 25 | 62 | 25 | 25 | 62 | 34 | 22 | 62 |

*Note: D= Dry PVG, M= Moist PVG and C= Cold PVG.*

Cold Upland Forest Group

Alternative 2 and 2 modified would decrease high density forest, while causing low and moderate density forest to increase over time. Alternative 3 similar results but move less forest towards Low and Moderate density classes. Gap openings (HPO) in all alternatives would reduce stand density to the Low Density Class in cold stands where high amounts of insect and disease activity is occurring and have a suppressed understory lacking early seral species components. Treatment would be cut below LMZ with

the primary objective to move the stand towards a more seral species composition, by creating adequate growing space for natural regeneration or planted early seral species.

Moist Upland Forest Group
Alternative 2 and 2 modified and 3 would decrease high density forest, while causing low and moderate density forest to increase over time. Intermediate treatments (HIM, HTH, PCT, WFM) would maintain dominants and co-dominates with 30-40% live crown ratio and reduce basal area to an average of 60-100 square feet/acre depending on plant association group. Decreased stand density would improve regeneration of shade intolerant species (Cochran & Seidel, 1999) and provide better resilience to fire, insects and disease. Spacing will be variable with gap openings resulting from areas that lack healthy early seral species.

Dry Upland Forest Group
Alternative 2 and 2 modified and 3 follows the same density trajectories were high density forest would decrease, while causing low and moderate density forest to increase over time. Intermediate treatments would focus on protecting old, large early seral species from crown fire by removing fuel ladders and heavy surface fuels from their immediate vicinity and in the broader surrounding landscape. Dominants and co-dominants would be reduced to an average of 40-80 square feet of basal area per acre depending on plant association group. As a result, residual tree vigor will increase and promote better resistance to insect attacks.

**Summary**
The overstocked stand conditions can have a major effect on landscape health and attaining the desired future condition (DFC) for the Two Eagle Project Area. In a healthy landscape there are areas of high density and low vigor, but to develop the DFC for much of the area, many of those stands need to be treated. To move towards more healthy stand and landscape condition, forest management needs to occur. Alternative 1 leaves the landscape in its current condition and carries with it a high risk of stand and landscape decline. Alternatives 2, 2 modified and 3 would reduce densities, alter stand compositions and provide for a more sustainable landscape. Alternatives 2 and 2 modified move the most acres toward low to moderate tree densities (Table 13); Alternative 2 modified changes non-commercial harvest units to biomass removal units, but does not affect densities changes. Alternative 3 would have the least number of acres into low to medium tree density classes.

Alternatives 2 modified and 2 would have the highest species composition percent change toward more resilient seral species than Alternatives 3 (Table 7-9). Stand species compositions that are within the historic range of variability assist in making the landscape more resilient and resistant to disturbances. Over the last century shifts in species composition and density have created vegetative conditions where insects, diseases, and wildfire may operate in uncharacteristic levels (Morgan and Parson, 2001). Stand management in the Two Eagle action alternatives would be a start toward creating a more resilient landscape by managing stand densities, species composition, and creating some heterogeneity in homogeneous areas.

As management occurs, the desired future condition of the area is to use the natural disturbance regime as a template to provide for a structure, density, and species composition mix across the landscape that is sustainable. This mixture would provide a degree of forage and habitat diversity for big game and other wildlife as well as wood fiber production.

**Common Effects**
Common to most harvest units are INFISH no-harvest buffers. Many of the no-harvest buffers have adequate regeneration, healthy trees and minimum amounts of mortality. Long term implications of these no-harvest buffers are minimized by site conditions. However, some density related mortality is expected and should provide for riparian needs.

In most units, snag levels would be met by retaining all existing snags. Maintaining these snags should have no adverse silvicultural effects.

Connective corridors would be maintained in the planning area. Corridors have certain requirements about distance and canopy closure. Stands treated with corridor requirements would tend to have higher densities and tree numbers that would increase density mortality, be less vigorous, and be at higher risk to fire damage.

Enhancement and KV projects and mitigation measures are part of all action alternatives, silvicultural effects of each follow:

1. Release Treatments (Non-commercial Thinning): would have positive silvicultural effects by reducing competition, increasing growth rates and helping to maintain species composition.
2. Prescribed Burning and Mechanical Fuels Reductions: burning and fuels reduction treatments would provide for additional openings within stands to assist natural and artificial regeneration and reduce the possibility of a fire damaging the residual stand.
3. Planting: would have positive silvicultural effects by providing: regeneration in stands that have few viable seedlings or saplings, structural component that is lacking in some stands, and tree densities at appropriate numbers.
4. Fire Fuels Reduction (FFU): biomass removal of down and suppressed material would have positive silvicultural effects by reducing the risk of future fires with the chance of a stand replacing event.

**Silvicultural Findings of Compliance with Laws, Regulations, and Policy**
Alternatives 2, 2 modified and 3 all comply with the goals for timber in the 1990 Wallowa-Whitman National Forest (WWNF) forest plan as amended by providing for production of wood fiber to satisfy national needs and benefit local economies consistent with multiple resource objectives, environmental constraints, and economic efficiency. Opportunities for fuelwood gathering for personal and commercial uses would be available within the project area. These alternative meet the forest plan standards and guidelines for timber because the prescription has been prepared and reviewed by a certified silviculturist, meets the silvicultural needs of the stands being treated including stand structure and species composition, limits created-opening sizes, utilizes the appropriate yarding system for stand and ground conditions, and calls for precommercial thinning of young stands to accelerate their growth. All action alternatives also propose to harvest timber on lands suitable for timber management (Table 11).

**Table 11- Unit Acres in Management Areas**

| Unit/ Mgt. Area | Acres in MA 1 | Acres in MA 7 |
|---|---|---|
| 1 | 31 | |
| 2 | 38 | |
| 4 | 15 | |

| | | |
|---|---|---|
| 5 | 32 | 8 |
| 7 | 10 | |
| 8 | 26 | |
| 9 | 12 | |
| 11 | 21 | |
| 13 | 18 | |
| 14 | 10 | |
| 15 | 12 | |
| 16 | 16 | |
| 17 | 5 | |
| 18 | 17 | |
| 21 | 41 | 25 |
| 22 | 99 | |
| 23 | | 29 |
| 24 | | 16 |
| 25 | | 8 |
| 26 | | 10 |
| 27 | 33 | |
| 28 | | 20 |
| 29 | | 13 |
| 30 | 8 | |
| 31 | 9 | |
| 32 | | 8 |
| 33 | | 18 |
| 34 | 49 | |
| 36 | 9 | |
| 38 | 21 | |
| 40 | | 23 |
| 41 | | 7 |
| 42 | 10 | |
| 43 | 92 | |
| 45 | | 50 |
| 48 | | 15 |
| 49 | 8 | 8 |
| 50 | 13 | |
| 51 | 18 | |
| 52 | 27 | |
| 54 | | 11 |
| 55 | 14 | |
| 56 | 5 | |
| 58 | 6 | |
| 60 | 14 | |
| 62 | 10 | |
| 64 | | 7 |
| 66 | | 54 |
| 68 | 18 | |
| 71 | 22 | |
| 74 | 3 | 19 |
| 75 | 13 | |
| 78 | 24 | |
| 79 | 11 | |
| 80 | 31 | |
| 84 | | 1 |
| 85 | 25 | |
| 86 | 14 | |
| 88 | 23 | |
| 89 | 65 | |
| 96 | 7 | |
| 97 | 17 | |
| 98 | 13 | |

| | | |
|---|---|---|
| 116 | 52 | |
| 117 | 27 | |
| 118 | 22 | |
| 119 | 8 | |
| 120 | 14 | |

Findings prepared by: Lucas Glick Date: 4/10/2018

Findings recommended by: _____ Date: _____

(Certified Silviculturist)

Findings accepted by: _____ Date: _____

(Line officer)

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